CHAPTER 5

Ethernet Cards

Note The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

The Cisco ONS 15454 SDH integrates Ethernet into a SDH time-division multiplexing (TDM) platform. This chapter describes the Cisco ONS 15454 SDH E-Series Ethernet cards, G-Series Ethernet cards, and ML-Series Ethernet cards. It includes descriptions, hardware specifications, and block diagrams for each card. For G-Series and E-Series Ethernet application information, see Chapter 14, "Ethernet Operation." For installation and card turn-up procedures, refer to the *Cisco ONS 15454 SDH Procedure Guide*. For ML-Series configuration information, see the *Ethernet Card Software Feature and Configuration Guide*.

Chapter topics include:

- 5.1 Ethernet Card Overview, page 5-1
- 5.2 E100T-G Card, page 5-2
- 5.3 E1000-2-G Card, page 5-4
- 5.4 G1000-4 Card, page 5-7
- 5.5 G1K-4 Card, page 5-8
- 5.6 ML100T-12 Card, page 5-10
- 5.7 ML1000-2 Card, page 5-12
- 5.8 GBICs and SFPs, page 5-14

5.1 Ethernet Card Overview

The card overview section summarizes card functions, power consumption, and temperature ranges.

Note Each card is marked with a symbol that corresponds to a slot (or slots) on the ONS 15454 SDH shelf assembly. The cards are then installed into slots displaying the same symbols. See the *Cisco ONS 15454 SDH Procedures Guide* for a list of slots and symbols.

5.1.1 Cards Summary

Table 5-1 lists the Cisco ONS 15454 SDH Ethernet cards.

Table 5-1 Ethernet Cards for the ONS 15454 SDH

Card	Port Description	For Additional Information...
E100T-G	The E100T-G card provides 12 switched, autosensing, 10/100BaseT Ethernet ports.	See the "5.2 E100T-G Card" section on page 5-2.
E1000-2-G	The E1000-2-G card provides two IEEE-compliant, 1000-Mbps ports. Gigabit Interface Converters (GBICs) are separate.	See the "5.3 E1000-2-G Card" section on page 5-4.
G1000-4	The G1000-4 card provides four IEEE-compliant, 1000-Mbps ports. GBICs are separate.	See the "5.4 G1000-4 Card" section on page 5-7.
G1K-4	The G1K-4 card provides four IEEE-compliant, 1000-Mbps ports. GBICs are separate. The G1K-4 card is functionally identical to the G1000-4 card.	See the "5.5 G1K-4 Card" section on page 5-8.
ML100T-12	The ML100T-12 card provides 12 switched, autosensing, 10/100Base-T Ethernet ports.	See the "5.6 ML100T-12 Card" section on page 5-10.
ML1000-2	The ML1000-2 card provides two IEEE-compliant, 1000-Mbps ports. Small form-factor pluggable (SFP) connectors are separate.	See the "5.7 ML1000-2 Card" section on page 5-12.

5.1.2 Card Compatibility

Table 5-2 lists the CTC software compatibility for each Ethernet card. See Table 2-6 on page 2-4 to determine Ethernet card cross-connect compatibility.

Table 5-2 Ethernet Card Software Compatibility

Ethernet Cards	R2.2.1	R2.2.2	R3.0.1	R3.1	R3.2	R3.3	R3.4	R4.0	R4.1	R4.5[1]	R4.6	R4.7[1]	R5.0
E100T-G	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes
E1000-2-G	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes
G1000-4	—	—	—	—	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes
G1K-4	—	—	—	—	Yes	Yes	Yes	Yes	Yes	—	Yes	—	Yes
ML100T-12	—	—	—	—	—	—	—	Yes	Yes	—	Yes	—	Yes
ML1000-2	—	—	—	—	—	—	—	Yes	Yes	—	Yes	—	Yes

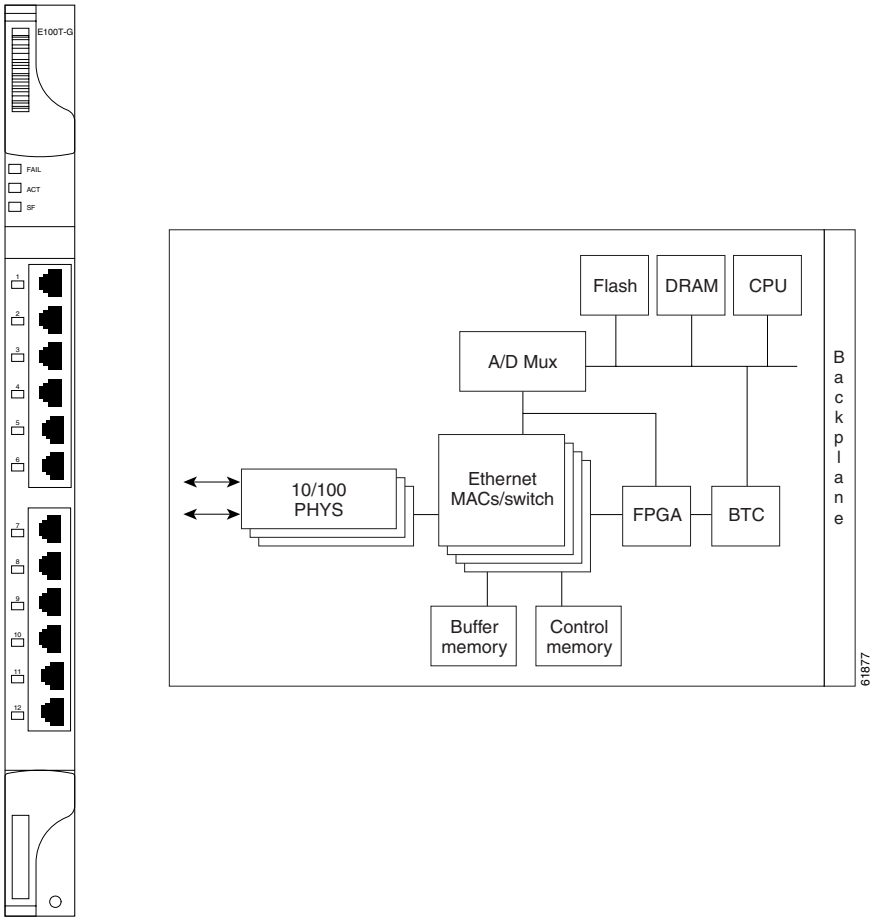
1. DWDM-only release.

5.2 E100T-G Card

The ONS 15454 SDH uses E100T-G cards for Ethernet (10 Mbps) and Fast Ethernet (100 Mbps). Each card provides 12 switched, IEEE 802.3-compliant, 10/100BaseT Ethernet ports that can independently detect the speed of an attached device (autosense) and automatically connect at the appropriate speed.

The ports autoconfigure to operate at either half or full duplex and determine whether to enable or disable flow control. You can also configure Ethernet ports manually. Figure 5-1 shows the faceplate and a block diagram of the card.

Figure 5-1 E100T-G Faceplate and Block Diagram



The E100T-G Ethernet card provides high-throughput, low-latency packet switching of Ethernet traffic across a SDH network while providing a greater degree of reliability through SDH self-healing protection services. This Ethernet capability enables network operators to provide multiple 10/100-Mbps access drops for high-capacity customer LAN interconnects, Internet traffic, and cable modem traffic aggregation. It enables the efficient transport and co-existence of traditional TDM traffic with packet-switched data traffic.

Each E100T-G card supports standards-based, wire-speed, Layer 2 Ethernet switching between its Ethernet interfaces. The IEEE 802.1Q tag logically isolates traffic (typically subscribers). IEEE 802.1Q also supports multiple classes of service.

5.2.1 E100T-G Slot Compatibility

You can install the E100T-G card in Slots 1 to 6 and 12 to 17. Multiple E-Series Ethernet cards installed in an ONS 15454 SDH can act independently or as a single Ethernet switch. You can create logical SDH ports by provisioning a number of SDH channels to the packet switch entity within the ONS 15454 SDH. Logical ports can be created with a bandwidth granularity of VC-4.

5.2.2 E100T-G Card-Level Indicators

The E100T-G card faceplate has three card-level LED indicators (Table 5-3).

Table 5-3 E100T-G Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the E100T-G card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the E100T-G. If the ACT LED is green, it indicates that the E100T-G card is active and the software is operational.
SF LED	Not used.

5.2.3 E100T-G Port-Level Indicators

The E100T-G card also has 12 pairs of LEDs (one pair for each port) to indicate port conditions (Table 5-4). You can find the status of the E100T-G card port using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot.

Table 5-4 E100T-G Port-Level Indicators

LED State	Description
Amber	Port is active (transmitting and/or receiving data). By default, indicates the transmitter is active but can be software controlled to indicate link status, duplex status, or receiver active.
Solid Green	Link is established. By default, indicates the link for this port is up, but can be software controlled to indicate duplex status, operating speed, or collision.

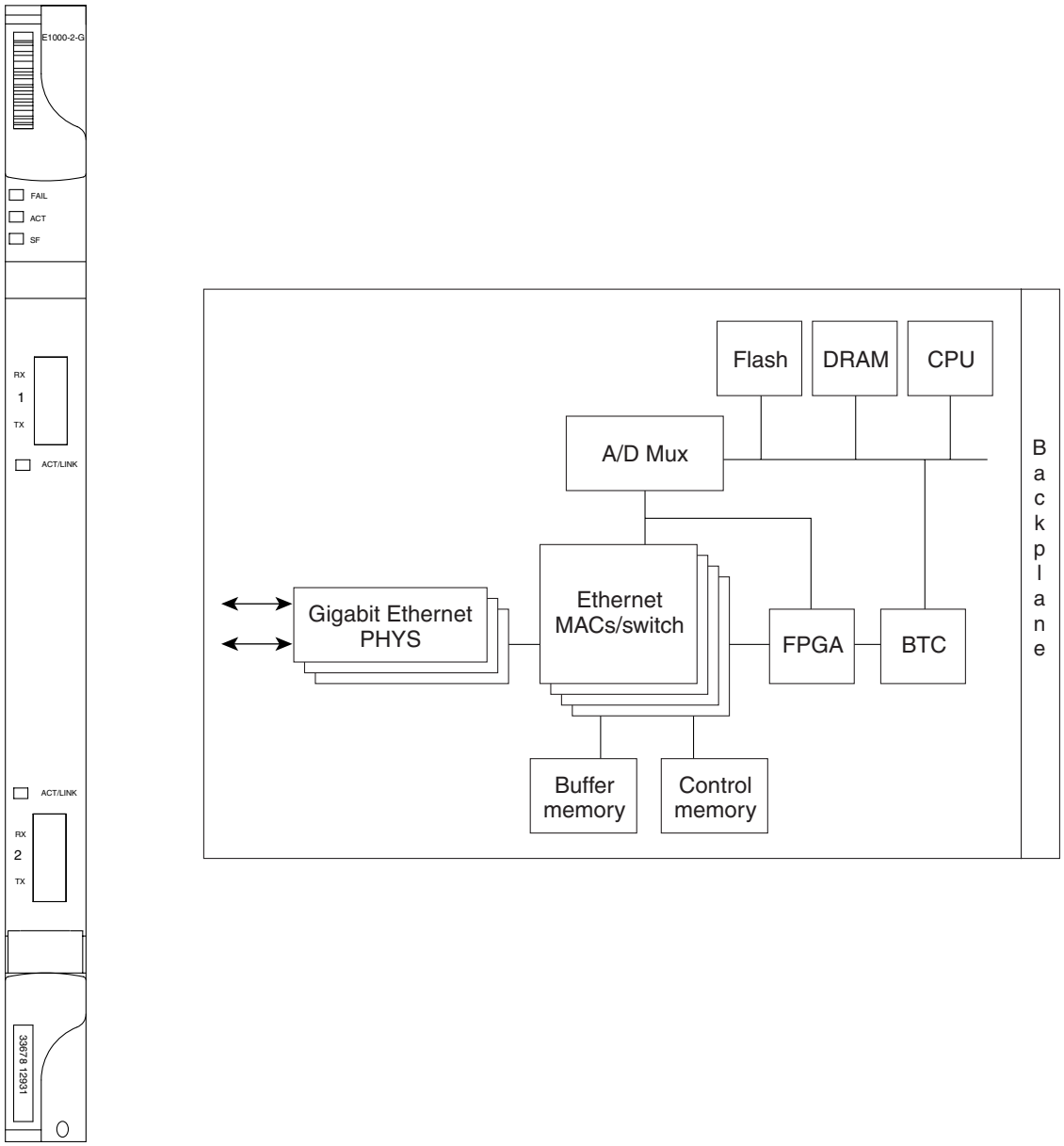
5.3 E1000-2-G Card

The ONS 15454 SDH uses E1000-2-G cards for Gigabit Ethernet (1000 Mbps). The E1000-2-G card provides two IEEE-compliant, 1000-Mbps ports for high-capacity customer LAN interconnections. Each port supports full-duplex operation.

The E1000-2-G card uses GBIC modular receptacles for the optical interfaces. For details, see the "5.8 GBICs and SFPs" section on page 5-14.

Figure 5-2 shows the card faceplate and a block diagram of the card.

Figure 5-2 E1000-2-G Faceplate and Block Diagram



The E1000-2-G Gigabit Ethernet card provides high-throughput, low-latency packet switching of Ethernet traffic across a SDH network while providing a greater degree of reliability through SDH self-healing protection services. This enables network operators to provide multiple 1000-Mbps access drops for high-capacity customer LAN interconnects. It enables efficient transport and co-existence of traditional TDM traffic with packet-switched data traffic.

Each E1000-2-G card supports standards-based, Layer 2 Ethernet switching between its Ethernet interfaces and SDH interfaces on the ONS 15454 SDH. The IEEE 802.1Q VLAN tag logically isolates traffic (typically subscribers).

Multiple E-Series Ethernet cards installed in an ONS 15454 SDH can act together as a single switching entity or as independent single switches supporting a variety of SDH port configurations.

You can create logical SDH ports by provisioning a number of SDH channels to the packet switch entity within the ONS 15454 SDH. Logical ports can be created with a bandwidth granularity of VC-4.

5.3.1 E1000-2-G Compatibility

The E1000-2-G is compatible with any traffic card slots (Slots 1 to 6 and 12 to 17).

5.3.2 E1000-2-G Card-Level Indicators

The E1000-2-G card faceplate has three card-level LED indicators (Table 5-5).

Table 5-5 E1000-2-G Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the E1000-2-G card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the E1000-2-G. If the ACT LED is green it indicates that the E1000-2-G card is active and the software is operational.
SF LED	Not used in this release.

5.3.3 E1000-2-G Port-Level Indicators

The E1000-2-G card also has one bicolor LED per port (Table 5-6). When the LINK LED is illuminated green, carrier is detected, meaning an active network cable is installed. When the LINK LED is not illuminated green, an active network cable is not plugged into the port, or the card is carrying unidirectional traffic. The port ACT LED flashes amber at a rate proportional to the level of traffic being received and transmitted over the port.

Table 5-6 E1000-2-G Port-Level Indicators

LED State	Description
Amber	The port is active (transmitting and receiving data).
Solid green	The link is established.
Green light off	The connection is inactive, or traffic is unidirectional.

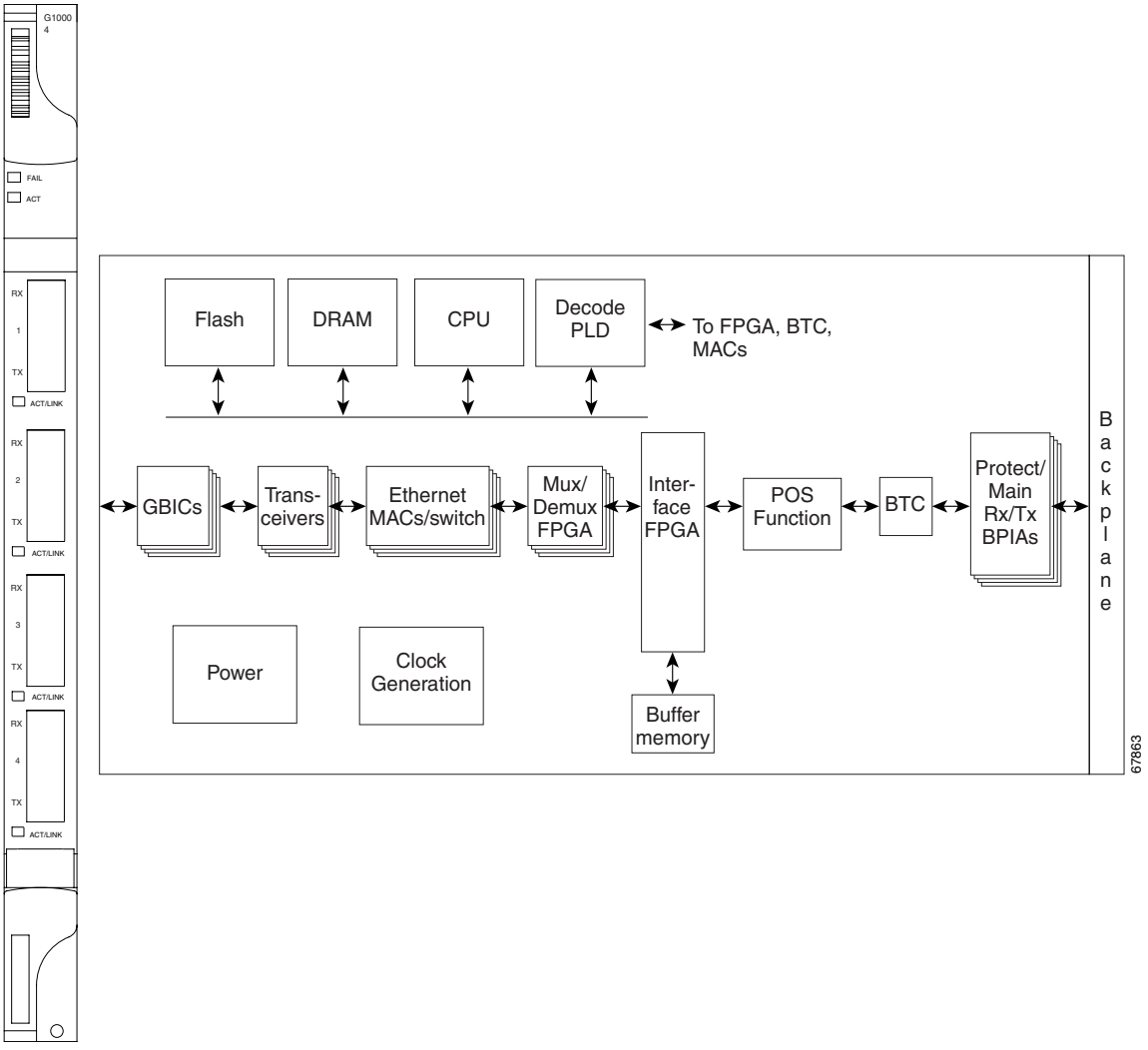
5.4 G1000-4 Card

The ONS 15454 SDH uses G1000-4 cards for Gigabit Ethernet (1000 Mbps). The G1000-4 card provides four ports of IEEE-compliant, 1000-Mbps interfaces. Each port supports full-duplex operation for a maximum bandwidth of STM-16 on each card.

The G1000-4 card uses GBIC modular receptacles for the optical interfaces. For details, see the "5.8 GBICs and SFPs" section on page 5-14.

Figure 5-3 shows the card faceplate and the block diagram of the card.

Figure 5-3 G1000-4 Faceplate and Block Diagram



The G1000-4 Gigabit Ethernet card provides high-throughput, low latency transport of Ethernet encapsulated traffic (IP and other Layer 3 protocols) across a SDH network. Carrier-class Ethernet transport is achieved by hitless (< 50 ms) performance in the event of any failures or protection switches (such as 1+1 automatic protection switching [APS], SNCP ring, or MS-SPRing. Full provisioning support is possible via Cisco Transport Controller (CTC) or Cisco Transport Manager (CTM). Each G1000-4 card performs independently of the other cards in the same shelf.

5.4.1 G1000-4 Card-Level Indicators

The G1000-4 card faceplate has two card-level LED indicators (Table 5-7).

Table 5-7 G1000-4 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (red)	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the G1000-4 card. As part of the boot sequence, the FAIL LED turns on; it turns off if the software is deemed operational. The red FAIL LED normally blinks when the card is loading software.
ACT LED (green)	A green ACT LED provides the operational status of the G1000-4. If the ACT LED is green, it indicates that the G1000-4 card is active and the software is operational.

5.4.2 G1000-4 Port-Level Indicators

The G1000-4 card has one bicolor LED per port. Table 5-8 describes the status that each color represents.

Table 5-8 G1000-4 Port-Level Indicators

Port-Level LED State	Description
Off	No link exists to the Ethernet port.
Steady amber	A link exists to the Ethernet port, but traffic flow is inhibited. For example, an unconfigured circuit, an error on line, or a nonenabled port might inhibit traffic flow.
Solid green	A link exists to the Ethernet port, but no traffic is carried on the port.
Flashing green	A link exists to the Ethernet port, and traffic is carried on the port. The LED flash rate reflects the traffic rate for the port.

5.4.3 G1000-4 Compatibility

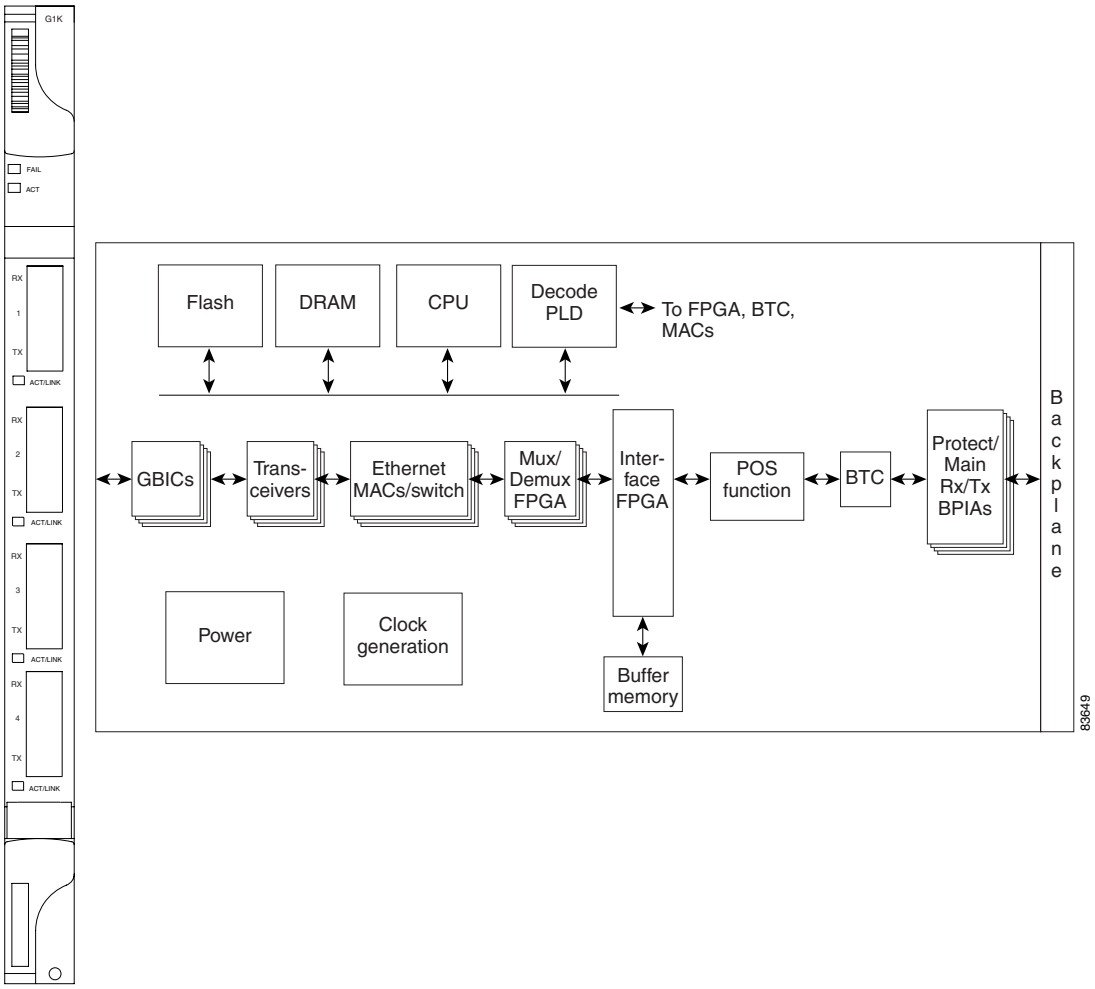
The G-Series card operates in Slots 1 to 6 and 12 to 17, for a total shelf capacity of 48 Gigabit Ethernet ports. The practical G1000-4 port per shelf limit is 40, because at least two slots are typically filled by OC-N trunk cards.

5.5 G1K-4 Card

The G1K-4 card is the functional equivalent of the G1000-4 card and provides four ports of IEEE-compliant, 1000-Mbps interfaces. Each interface supports full-duplex operation for a maximum bandwidth of 1 Gbps or 2 Gbps bidirectional per port, and 2.5 Gbps or 5 Gbps bidirectional per card. Each port autonegotiates for full duplex and IEEE 802.3x flow control. The G1K-4 card uses GBIC modular receptacles for the optical interfaces. For details, see the "5.8 GBICs and SFPs" section on page 5-14.

Figure 5-4 shows the card faceplate and the block diagram of the card.

Figure 5-4 G1K-4 Faceplate and Block Diagram



The G1K-4 Gigabit Ethernet card provides high-throughput, low-latency transport of Ethernet encapsulated traffic (IP and other Layer 3 protocols) across a SDH network while providing a greater degree of reliability through SDH self-healing protection services. Carrier-class Ethernet transport is achieved by hitless (< 50 ms) performance in the event of any failures or protection switches (such as 1+1 APS, path protection, BLSR, or optical equipment protection) and full provisioning and manageability, as in SDH service. Full provisioning support is possible via CTC or CTM. Each G1K-4 card performs independently of the other cards in the same shelf.

5.5.1 G1K-4 Compatibility

Software R4.0 and later identifies G1K-4 cards as G1K-4s upon physical installation. Software prior to R4.0 identifies both G1000-4 and G1K-4 cards as G1000-4s upon physical installation.

You can install the G1K-4 card in Slots 1 to 6 and 12 to 17, for a total shelf capacity of 48 Gigabit Ethernet ports. (The practical limit is 40 ports because at least two slots are typically populated by optical cards such as the OC-192.)

5.5.2 G1K-4 Card-Level Indicators

The G1K-4 card faceplate has two card-level LED indicators, described in Table 5-9.

Table 5-9 G1K-4 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (red)	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the G1K-4 card. As part of the boot sequence, the FAIL LED is turned on, and it goes off when the software is deemed operational. The red FAIL LED blinks when the card is loading software.
ACT LED (green)	A green ACT LED provides the operational status of the G1K-4. If the ACT LED is green, it indicates that the G1K-4 card is active and the software is operational.

5.5.3 G1K-4 Port-Level Indicators

The G1K-4 card has four bicolor LEDs (one LED per port). Table 5-10 describes these LEDs.

Table 5-10 G1K-4 Port-Level Indicators

Port-Level LED State	Description
Off	No link exists to the Ethernet port.
Steady amber	A link exists to the Ethernet port, but traffic flow is inhibited. For example, a lack of circuit setup, an error on the line, or a nonenabled port might inhibit traffic flow.
Solid green	A link exists to the Ethernet port, but no traffic is carried on the port.
Flashing green	A link exists to the Ethernet port, and traffic is carried on the port. The LED flash rate reflects the traffic rate for the port.

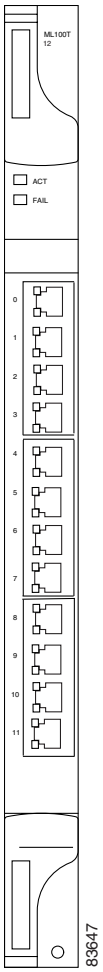
5.6 ML100T-12 Card

The ML100T-12 card provides 12 ports of IEEE 802.3-compliant, 10/100 interfaces. Each interface supports full-duplex operation for a maximum bandwidth of 200 Mbps per port and 2.488 Gbps per card. Each port independently detects the speed of an attached device (autosenses) and automatically connects at the appropriate speed. The ports autoconfigure to operate at either half or full duplex and can determine whether to enable or disable flow control. For ML-Series configuration information, see the *Cisco ONS 15454 SONET/SDH ML-Series Multilayer Ethernet Card Software Feature and Configuration Guide.*

Figure 5-5 shows the card faceplate.

Caution Shielded twisted-pair cabling should be used for inter-building applications.

Figure 5-5 ML100T-12 Faceplate



ML-Series cards feature two SDH virtual ports with a maximum combined bandwidth of VC4-16c. Each port carries an STM circuit with a size of VC3, VC4, VC4-2c, VC4-3c, VC4-4c, and VC4-8c. For step-by-step instructions on configuring an ML-Series card SDH STM circuit, refer to the "Create Circuits and Tunnels" chapter of the *Cisco ONS 15454 SDH Procedure Guide.*

The ML-Series packet-over-SDH (POS) ports supports virtual concatenation (VCAT) of SONET/SDH circuits and a software link capacity adjustment scheme (SW-LCAS). The ML-Series card supports a maximum of two VCAT groups with each group corresponding to one of the POS ports. Each VCAT group must be provisioned with two circuit members. An ML-Series card supports VC-3-2v, VC-4-2v and VC-4-4c-2v. For step-by-step instructions on configuring an ML-Series card SDH VCAT circuit, refer to the "Create Circuits and Tunnels" chapter of the *Cisco ONS 15454 SDH Procedure Guide.*

5.6.1 ML100T-12 Card-Level Indicators

The ML00T-12 card supports two card-level LED indicators, described in Table 5-11.

Table 5-11 ML100T-12 Card-Level Indicators

Card-Level LEDs	Description
Red SF LED	The red SF LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the ML100T-12 card. As part of the boot sequence, the FAIL LED is illuminated until the software deems the card operational.
Green ACT LED	A green ACT LED provides the operational status of the ML100T-12. If the ACT LED is green, it indicates that the ML100T-12 card is active and the software is operational.

5.6.2 ML100T-12 Port-Level Indicators

The ML100T-12 card provides a pair of LEDs for each Fast Ethernet port: an amber LED for activity (ACT) and a green LED for LINK. The port-level indicators are described in Table 5-12.

Table 5-12 ML100T-12 Port-Level Indicators

Port-Level LED State	Description
ACT LED (Amber)	Steady amber LED indicates that a link is detected, but there is an issue inhibiting traffic. Blinking amber LED means that traffic is flowing.
LINK LED (Green)	Steady green LED indicates that a link is detected, but there is no traffic. Blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED	Unlit green and amber LEDs indicate no traffic.

5.6.3 ML100T-12 Slot Compatibility

The ML100T-12 card works in Slots 1 to 6 or 12 to 17.

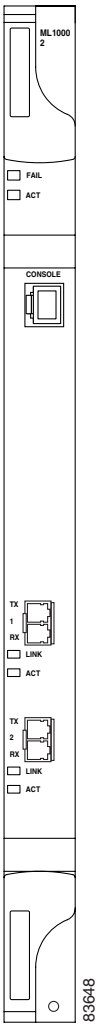
5.7 ML1000-2 Card

The ML1000-2 card provides two ports of IEEE-compliant, 1000-Mbps interfaces. Each interface supports full-duplex operation for a maximum bandwidth of 2 Gbps per port and 4 Gbps per card. Each port autoconfigures for full duplex and IEEE 802.3x flow control.

SFP modules are offered as separate orderable products for maximum customer flexibility. For details, see the "5.8 GBICs and SFPs" section on page 5-14.

Figure 5-6 shows the ML1000-2 card faceplate.

Figure 5-6 ML1000-2 Faceplate



ML-Series cards feature two SDH virtual ports with a maximum combined bandwidth of VC4-16c. Each port carries an STM circuit with a size of VC3, VC4, VC4-2c, VC4-3c, VC4-4c, and VC4-8c. For step-by-step instructions on configuring an ML-Series card SDH STM circuit, refer to the "Create Circuits and Tunnels" chapter of the *Cisco ONS 15454 SDH Procedure Guide.*

The ML-Series POS ports supports VCAT of SONET/SDH circuits and a software link capacity adjustment scheme (SW-LCAS). The ML-Series card supports a maximum of two VCAT groups with each group corresponding to one of the POS ports. Each VCAT group must be provisioned with two circuit members. An ML-Series card supports VC-3-2v, VC-4-2v and VC-4-4c-2v. For step-by-step instructions on configuring an ML-Series card SDH VCAT circuit, refer to the "Create Circuits and Tunnels" chapter of the *Cisco ONS 15454 SDH Procedure Guide.*

5.7.1 ML1000-2 Card-Level Indicators

The ML1000-2 card faceplate has two card-level LED indicators, described in Table 5-13.

Table 5-13 ML1000-2 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (Red)	The red FAIL LED indicates that the card's processor is not ready or that a catastrophic software failure occurred on the ML1000-2 card. As part of the boot sequence, the FAIL LED is turned on until the software deems the card operational.
ACT LED (Green)	A green ACT LED provides the operational status of the ML1000-2. When the ACT LED is green, it indicates that the ML1000-2 card is active and the software is operational.

5.7.2 ML1000-2 Port-Level Indicators

The ML1000-2 card has two LEDs for each of the two Gigabit Ethernet ports. The port-level indicators are described in Table 5-14.

Table 5-14 ML1000-2 Port-Level Indicators

Port-Level LED State	Description
ACT LED (Amber)	Steady amber LED indicates that a link is detected, but there is an issue inhibiting traffic. Blinking amber LED means that traffic is flowing.
LINK LED (Green)	Steady green LED indicates that a link is detected, but there is no traffic. Blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED	Unlit green and amber LEDs indicate no traffic.

5.7.3 ML1000-2 Slot Compatibility

The ML1000-2 card works in Slots 1 to 6 or 12 to 17.

5.8 GBICs and SFPs

This section describes the GBICs and SFPs used with the Ethernet cards.

The ONS 15454 SDH Ethernet cards use industry standard small form-factor pluggable connectors (SFPs) and Gigabit Interface Converter (GBIC) modular receptacles. The ML-Series Gigabit Ethernet cards use standard Cisco SFPs. The Gigabit E-Series card and the G-Series card use standard Cisco GBICs. With Software Release 4.1 and later, G-Series cards can also be equipped with dense wavelength division multiplexing (DWDM) and coarse wavelength division multiplexing (CWDM) GBICs to function as Gigabit Ethernet transponders.

For all Ethernet cards, the type of GBIC or SFP plugged into the card is displayed in CTC and TL1. Cisco offers SFPs and GBICs as separate orderable products.

5.8.1 Compatibility by Card

Table 5-15 lists Cisco ONS 15454 SDH Ethernet cards with their compatible GBICs and SFPs.

Caution Only use GBICs and SFPs certified for use in Cisco Optical Networking Systems. The qualified Cisco GBIC and SFP pluggable module's top assembly numbers (TANs) are provided in Table 5-15.

Table 5-15 GBIC and SFP Card Compatibility

Card	Compatible GBIC or SFP (Cisco Product ID)	Cisco Top Assembly Number (TAN)
E1000-2-G (ONS 15454 SONET) E1000-2 (ONS 15454 SONET/SDH)	15454-GBIC-SX 15454E-GBIC-SX 15454-GBIC-LX/LH 15454E-GBIC-LX/LH	30-0759-01 800-06780-01[1] 10-1743-01 30-0703-01
FC_MR-4 (ONS 15454 SONET/SDH)	15454-GBIC-SX 15454E-GBIC-SX 15454-GBIC-LX/LH 15454E-GBIC-LX/LH ONS-GX-2FC-MMI ONS-GX-2FC-SML	30-0759-01 800-06780-01 10-1743-01 30-0703-01 10-2015-01 10-2016-01
G1K-4 (ONS 15454 SONET/SDH) G1000-4 (ONS 15454 SONET/SDH)	15454-GBIC-SX 15454E-GBIC-SX 15454-GBIC-LX/LH 15454E-GBIC-LX/LH 15454-GBIC-ZX 15454E-GBIC-ZX 15454-GBIC-xx.x[2] 15454E-GBIC-xx.x[2] 15454-GBIC-xxxx[3] 15454E-GBIC-xxxx[3]	30-0759-01 800-06780-01 10-1743-01 30-0703-01 30-0848-01 10-1744-01 10-1845-01 through 10-1876-01 10-1845-01 through 10-1876-01 10-1453-01 through 10-1460-01 10-1453-01 through 10-1460-01
ML1000-2 (ONS 15454 SONET/SDH)	15454-SFP-LC-SX 15454E-SFP-LC-SX 15454-SFP-LC-LX/LH 15454E-SFP-LC-LX/LH	30-1301-01 30-1301-01 30-1299-01 30-1299-01

1. This TAN is only compatible with ONS 15454-E1000-2 or 15454-E1000-2-G cards.
2. xx.x defines the 32 possible wavelengths as shown in Table A-1 on page A-4.
3. xxxx defines the 8 possible wavelengths as shown in Table 5-16 on page 5-17.

5.8.2 GBIC Description

GBICs are integrated fiber optic transceivers that provide high speed serial links from a port or slot to the network. Various latching mechanisms can be utilized on the GBIC pluggable modules. There is no correlation between the type of latch to the model type (such as SX or LX/LH) or technology type (such as Gigabit Ethernet). See the label on the GBIC for technology type and model. One GBIC model has two clips (one on each side of the GBIC) that secure the GBIC in the slot on the Ethernet card; the other has a locking handle. Both types are shown in Figure 5-7.

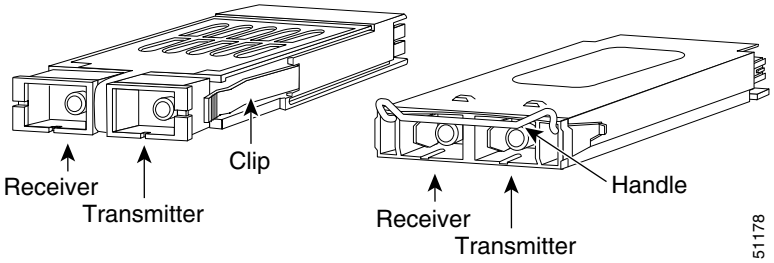
GBIC dimensions are:

- Height 0.39 in. (1 cm)
- Width 1.18 in. (3 cm)
- Depth 2.56 in. (6.5 cm)

GBIC temperature ranges are:

- COM—commercial operating temperature range -5°C to 70°C
- EXT—extended operating temperature range 0°C to 85°C
- IND—industrial operating temperature range -40°C to 85°C

Figure 5-7 GBICs with Clips (left) and with a Handle (right)



5.8.2.1 DWDM and CWDM GBICs

DWDM (15454-GBIC-xx.x, 15454E-GBIC-xx.x) and CWDM (15454-GBIC-xxxx, 15454E-GBIC-xxxx) GBICs operate in the ONS 15454 G-Series card when the card is configured in Gigabit Ethernet Transponding mode or in Ethernet over SDH mode. DWDM and CWDM GBICs are both wavelength division multiplexing (WDM) technologies and operate over single-mode fibers with SC connectors. Cisco CWDM GBIC technology uses a 20 nm wavelength grid and Cisco ONS 15454 DWDM GBIC technology uses a 1 nm wavelength grid. CTC displays the specific wavelengths of the installed CWDM or DWDM GBICs. DWDM wavelengths are spaced closer together and require more precise lasers than CWDM. The DWDM spectrum allows for optical signal amplification. For more information on G-Series card transponding mode, see the *Cisco ONS 15454 Reference Manual*.

The DWDM and CWDM GBICs receive across the full 1300 nm and 1500 nm bands, which includes all CWDM, DWDM, LX/LH, ZX wavelengths, but transmit on one specified wavelength. This capability can be exploited in some of the G-Series transponding modes by receiving wavelengths that do not match the specific transmission wavelength.

Note G1000-4 cards support CWDM and DWDM GBICs. G1K-4 cards with the Common Language Equipment Identification (CLEI) code of WM5IRWPCAA (manufactured after August 2003) support CWDM and DWDM GBICs. G1K-4 cards manufactured prior to August 2003 do not support CWDM or DWDM GBICs.

The ONS 15454-supported CWDM GBICs reach up to 100 to 120 km over single-mode fiber and support eight wavelengths as shown in Table 5-16.

Table 5-16 Supported Wavelengths for CWDM GBICs

CWDM GBIC Wavelengths	1470 nm	1490 nm	1510 nm	1530 nm	1550 nm	1570 nm	1590 nm	1610 nm
Corresponding GBIC Colors	Gray	Violet	Blue	Green	Yellow	Orange	Red	Brown
Band	47	49	51	53	55	57	59	61

The ONS 15454-supported DWDM GBICs reach up to 100 to 120 km over single-mode fiber and support 32 different wavelengths in the red and blue bands. Paired with optical amplifiers, such as the Cisco ONS 15216, the DWDM GBICs allow maximum unregenerated spans of approximately 300 km (Table 5-17).

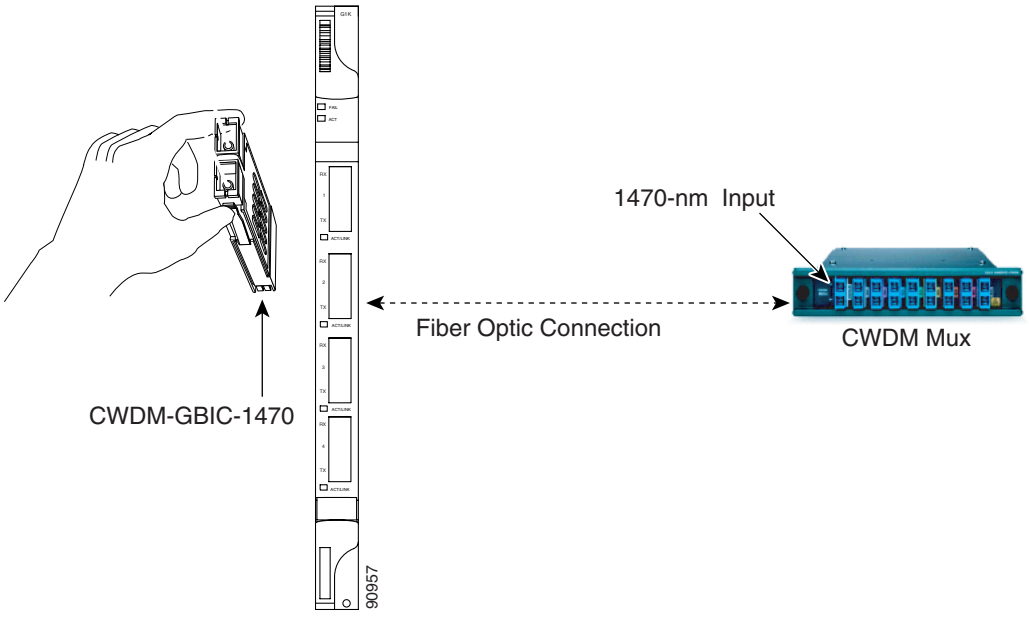
Table 5-17 Supported Wavelengths for DWDM GBICs

Blue Band	1530.33 nm	1531.12 nm	1531.90 nm	1532.68 nm	1534.25 nm	1535.04 nm	1535.82 nm	1536.61 nm
	1538.19 nm	1538.98 nm	1539.77 nm	1540.56 nm	1542.14 nm	1542.94 nm	1543.73 nm	1544.53 nm
Red Band	1546.12 nm	1546.92 nm	1547.72 nm	1548.51 nm	1550.12 nm	1550.92 nm	1551.72 nm	1552.52 nm
	1554.13 nm	1554.94 nm	1555.75 nm	1556.55 nm	1558.17 nm	1558.98 nm	1559.79 nm	1560.61 nm

5.8.2.1.1 Placement of CWDM or DWDM GBICs

CWDM or DWDM GBICs for the G-Series card come in set wavelengths and are not provisionable. The wavelengths are printed on each GBIC, for example, CWDM-GBIC-1490. The user must insert the specific GBIC transmitting the wavelength required to match the input of the CWDM/DWDM device for successful operation (Figure 5-8). Follow your site plan or network diagram for the required wavelengths.

Figure 5-8 CWDM GBIC with Wavelength Appropriate for Fiber-Connected Device

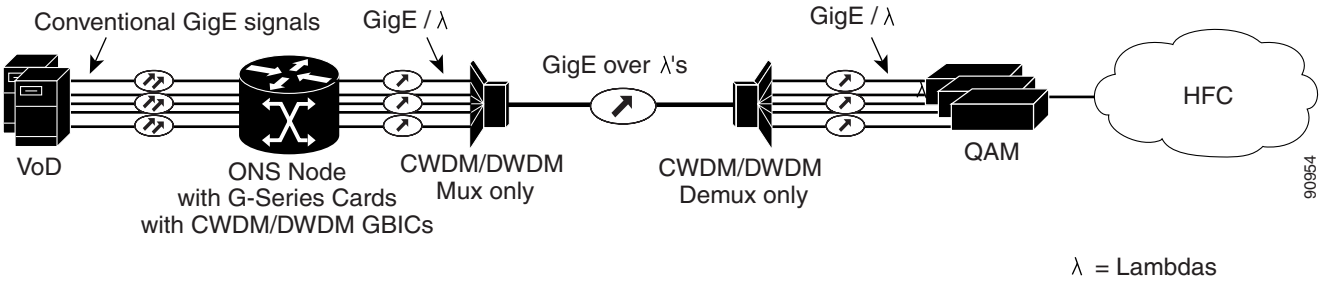


The *Cisco ONS 15454 SDH Procedure Guide* contains specific procedures for attaching optical fiber to GBICs and inserting GBICs into the G-Series card.

5.8.2.1.2 Example of CWDM or DWDM GBIC Application

A G-Series card equipped with CWDM or DWDM GBICs supports the delivery of unprotected Gigabit Ethernet service over Metro DWDM (Figure 5-9). It can be used in short-haul and long-haul applications.

Figure 5-9 G-Series with CWDM/DWDM GBICs in Cable Network



5.8.3 SFP Description

SFPs are integrated fiber optic transceivers that provide high speed serial links from a port or slot to the network. Various latching mechanisms can be utilized on the SFP modules. There is no correlation between the type of latch to the model type (such as SX or LX/LH) or technology type (such as Gigabit Ethernet). See the label on the SFP for technology type and model. One type of latch available is a mylar tab (Figure 5-10), a second type of latch available is an actuator/button (Figure 5-11), and a third type of latch is a bail clasp (Figure 5-12).

SFP dimensions are:

- Height 0.03 in. (8.5 mm)
- Width 0.53 in. (13.4 mm)
- Depth 2.22 in. (56.5 mm)

SFP temperature ranges for are:

- COM—commercial operating temperature range -5°C to 70°C
- EXT—extended operating temperature range -5°C to 85°C
- IND—industrial operating temperature range -40°C to 85°C

Figure 5-10 Mylar Tab SFP

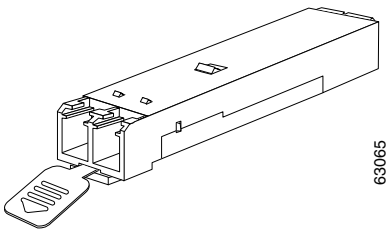


Figure 5-11 Actuator/Button SFP

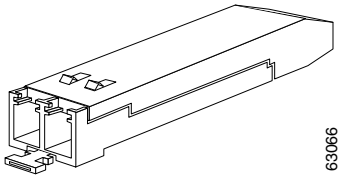


Figure 5-12 Bail Clasp SFP